

PATENT COOPERATION TREATY
PCT
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

REC'D 25 MAY 2004

WIPO PCT

(PCT Article 36 and Rule 70)

21 JUL 2004

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| Applicant's or agent's file reference P 03-015/FA | FOR FURTHER ACTION See Form PCT/IPEA/416 | |
| International application No. PCT/SE2003/000109 | International filing date (day/month/year) 22.01.2003 | Priority date (day/month/year) 22.01.2002 |
| International Patent Classification (IPC) or national classification and IPC B60K 17/14, B62D 7/02, G05D 1/03 | | |
| Applicant Visual Act Scandinavia AB et al | | |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

a. (*sent to the applicant and to the International Bureau*) a total of 3 sheets, as follows:

- sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
- sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. (*sent to the International Bureau only*) a total of (indicate type and number of electronic carrier(s))
, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

| | | |
|-------------------------------------|--------------|---|
| <input checked="" type="checkbox"/> | Box No. I | Basis of the report |
| <input type="checkbox"/> | Box No. II | Priority |
| <input type="checkbox"/> | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| <input type="checkbox"/> | Box No. IV | Lack of unity of invention |
| <input checked="" type="checkbox"/> | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| <input type="checkbox"/> | Box No. VI | Certain documents cited |
| <input type="checkbox"/> | Box No. VII | Certain defects in the international application |
| <input type="checkbox"/> | Box No. VIII | Certain observations on the international application |

| | |
|---|---|
| Date of submission of the demand 10.07.2003 | Date of completion of this report 17.05.2004 |
| Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88 | Authorized officer Per-Olof Warnbo / MRO Telephone No. +46 8 782 25 00 |

Form PCT/IPEA/409 (cover sheet) (January 2004)

CORRECTED

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International Application No.

PCT/SE2003/000109

Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

international search (under Rules 12.3 and 23.1(b))
 publication of the international application (under Rule 12.4)
 international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

the international application as originally filed/furnished

the description: .

pages 1 - 7 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

the claims: .

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 1 - 3 received by this Authority on 13.05.2004

pages* _____ received by this Authority on _____

the drawings: .

pages 1 - 3 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. The amendments have resulted in the cancellation of:

the description, pages _____

the claims, Nos. _____

the drawings, sheets/figs _____

the sequence listing (specify): _____

any table(s) related to the sequence listing (specify): _____

4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

the description, pages _____

the claims, Nos. _____

the drawings, sheets/figs _____

the sequence listing (specify): _____

any table(s) related to the sequence listing (specify): _____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International Application No.

PCT/SE2003/000109

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

| | | | |
|-------------------------------|--------|-------------|-----|
| Novelty (N) | Claims | <u>1-16</u> | YES |
| | Claims | _____ | NO |
| Inventive step (IS) | Claims | <u>1-16</u> | YES |
| | Claims | _____ | NO |
| Industrial applicability (IA) | Claims | <u>1-16</u> | YES |
| | Claims | _____ | NO |

2. Citations and explanations (Rule 70.7)

- D1) US A, 5 436 332
- D2) US, A, 3 404 746
- D3) US, A, 5 924 512
- D4) US, A, 5 432 416
- D5) US, A, 4 044 853
- D6) US, A, 3 912 037

The present invention relates to a drive unit and a powered vehicle.

The main purpose of the invention is to provide a drive unit, which not causes damage to the floor surface caused by slippage, due to rotation of the drive wheel at slow speeds or at standstill.

The solution according to the invention is that the drive unit comprising a rolling means intended to be in frictional engagement with a surface over which the drive unit is intended to move, a first driving means and a second driving means, co-operatively operable to provide both propulsion and steering of the drive unit while eliminating slippage between the rolling means and the surface. The first driving means is arranged on a rotatable support means rotatable about a center axis and is operable to rotate the rolling means about a rolling axis, wherein the rolling means is displaced a predetermined distance from the center axis, wherein the second driving means is operable to rotate the support means about the center axis, allowing the support means and the rolling means to rotate with respect to the drive unit.

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: BOX V.

D1 discloses a automated guided vehicles, autonomous mobile robots, remotely controlled robots, and the like, and more particularly, to a multiple-degree-of-freedom vehicle wherein wheel slippage is eliminated and/or rendered inconsequential by permitting the distance between two drive chassis on the same vehicle to be monitored and using a resulting distance measurement signal to control vehicle operation.

D2 discloses a motor-driven vehicle which can change direction, which includes a circular platform rotably mounted in a bearing. The platform carries a motor (not shown) which may be an electric motor or an internal combustion engine, in a housing. The motor has an output pulley which drives, through a belt a pulley wheel 54 mounted for rotation with the drive wheel. The platform has a gear wheel coaxially secured thereto. The gear wheel meshes with an idler gear which, in turn meshes with a gear mounted on the lower end of a steering shaft journaled in a column and carrying a steering wheel on its upper end. Thus, turning of the steering wheel rotates the platform to alter the direction of the driving wheel. The ratios of the gears are chosen to provide the desired turning effect of the drive wheel for one complete rotation of the steering wheel.

D3 discloses a vehicle, which has a driving wheel (1) which serves as a steering wheel rotatably supported through a wheel shaft (2) by a suspension (3). The wheel shaft is coupled to a motor shaft (5) that serves as an actuator through a reduction gear (4). An encoder (6) attached to the end of the motor detects the turning angle of the driving wheel. The upper end of the suspension is supported about a vertical axis through a shaft bush (8) and is displaced by a horizontal distance (S) from the contact point between the driving wheel and the ground. A coaxial gear (9) on the upper face of the suspension is coupled with a gear (11) supported on the body and coupled the motor output shaft (13).

D4 discloses a self-propelled robot, which has a robot body on which a drive wheel is mounted. The drive wheel is connected to a member that can be turned about a vertical axis for steering the robot. A propulsion drive mechanism is mounted on that member for transmitting a propulsion drive to the drive wheel. The propulsion drive mechanism includes a clutch mechanism for disengaging the propulsion drive when the drive

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: Box V.

wheel encounters excessive resistance to travel. The clutch mechanism includes a spring biased clutch element mounted on an internal spline shaft of the drive wheel.

D5 discloses a driverless vehicle, which has an elongated frame supported at each of its ends by a steerable wheel and a castor wheel, the steerable wheels being mounted in longitudinal alignment, and one of the steerable wheels is reversibly driven. Each steerable wheel is individually controllable by a guidance system including a steering motor, forward and reverse direction sensing units which obtain a steering signal from a guide path, and a circuit for controlling the steering motor in response to the steering signal. In automatic operation of the vehicle, the individually controllable steerable wheels will follow a common guide path or separate guide paths so that the vehicle can move forwardly, rearwardly and laterally. Manual controls enable an operator to steer and energize the drive wheel, to steer the other steerable wheel and to separately activate and deactivate the guidance systems for the steerable wheels.

D6 discloses a transport vehicle for a transport system, which being controlled along a predetermined path of movement by means of a signal generating system. The transport vehicle including: a signal receiver, at least three wheels which may be pivoted about approximately vertical, mutually spaced steering axes and a motor-driven driving and steering system for at least two of said wheels, said driving and steering system being controllable both with respect to the speed as well as the angle of turn of the driving or driven wheels by means of the signal receiver in response to control signals produced by the signal generating system.

None of the cited documents (D1-D6) in the International Search Report shows a drive unit and a powered vehicle in accordance with the amended claims (13-05-2004).

Therefore the subject matter of claims 1-16 is novel. The claimed invention is also considered to involve an inventive step and there is no reason to doubt its industrial applicability.

CLAIMS

1. A drive unit comprising a rolling means intended to be in frictional engagement with a surface over which said drive unit is intended to move, a first driving means and a second driving means, co-operatively operable to provide both propulsion and steering of said drive unit while eliminating slippage between said rolling means and said surface, **characterized** in that said first driving means is arranged on a rotatable support means rotatable about a center axis and is operable to rotate said rolling means about a rolling axis, wherein said rolling means is displaced a predetermined distance from said center axis, wherein said second driving means is operable to rotate said support means about said center axis, allowing said support means and said rolling means to rotate with respect to said drive unit.
2. A drive unit according to Claim 1, **characterized** in that said rolling axis is perpendicular to said center axis.
3. A drive unit according to anyone of Claims 1-2, **characterized** in that said support means on its circumference is provided with a sprocket means driven by said second driving means by way of a transmission means.
4. A drive unit according to Claim 3, **characterized** in that said transmission means is a chain which is engaged with said sprocket means and a toothed wheel driven by said second driving means.
5. A drive unit according to Claim 4, **characterized** in that said drive unit also comprises a tension wheel which is engaged with said chain.
6. A drive unit according to Claim 3, **characterized** in that said transmission means is a toothed wheel driven by said second driving means, wherein said toothed wheel is engaged with said sprocket means.

7. A drive unit according to anyone of Claims 1-6, **characterized** in that said drive unit also comprises a planetary gear-box mounted on said first driving means, and in connection with said rolling means.
8. A drive unit according to anyone of Claims 1-7, **characterized** in that said rotatable support means is supported by a ball bearing means.
9. A drive unit according to anyone of Claims 1-8, **characterized** in that said first and second driving means, each is a servomotor.
10. A drive unit according to anyone of Claims 1-9, **characterized** in that said rolling means is a wheel.
11. A drive unit according to anyone of Claims 1-10, **characterized** in that said support means is a round plate.
12. A drive unit according to anyone of Claims 1-11, **characterized** in that said drive unit also comprises a rotation limiter arranged in the vicinity of said rotatable support means.
13. A drive unit according to anyone of Claims 1-12, **characterized** in that said drive unit also comprises a sensor means arranged in the vicinity of said rotatable support means, which sensor means is operable to detect the position of said rotatable support means.
14. A powered vehicle comprising a chassis, at least three rolling means mounted on said chassis for engagement with a surface over which said vehicle is to move, **characterized** in that at least two of said rolling means each is a drive unit according to anyone of Claims 1-13.

15. A powered vehicle according to Claim 14, **characterized** in that said powered vehicle comprises four rolling means, each situated at a corner of said chassis, and in that two of said four rolling means are drive units, each arranged at two diagonally arranged corners of said powered vehicle.

16. A powered vehicle according to Claim 14 or Claim 15, **characterized** in that said powered vehicle also comprises a wireless communication means for receiving control signals from a remote computer system to control said drive units.
